

Magnetoresistance in the Junction with Multiferroic BiFeO₃

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1. Introduction

Multiferroics with magnetic and electric order have attracted much attention because of strong magnetoelectric coupling in these materials. Particularly, BiFeO₃ (BFO) is the promising material because of high magnetic and electric transition temperature. Since some reports indicate interfacial ferromagnetism at BiFeO₃/ferromagnet interfaces[1], enhancement of magnetoelectric coupling is expected on these junctions. In this work, it was found that the resistance of the La_{0.6}Sr_{0.4}MnO₃ (LSMO)/BFO-junction monotonically decreased under magnetic field in low temperature, which behavior was similar to colossal magnetoresistance (CMR) in perovskite manganites such as LSMO.

2. Experimental Method

SrTiO₃ sub./La_{0.6}Sr_{0.4}MnO₃(70)/BiFeO₃(20)/Ru(2)/Au(10) (thickness in nm) junction was prepared by r.f. magnetron sputtering. Conventional photolithography and Ar ion milling techniques were used for processing. Electric conductive properties (R - T , R - H , and I - V curves) were measured using PPMS and pico-ammeter (Keithley 6487).

3. Experimental Results

Fig. 1 shows the R - T curves for the LSMO/BFO-junction and the LSMO single-layer. Resistance of LSMO decreased with temperature after magnetic transition at ~ 320 K. On the other hand, resistance of the LSMO/BFO-junction increased with decreasing temperature. Fig. 2 shows the R - H curves for the junction at 50 K. Junction resistance decreased with increasing magnetic field. The R - H property was similar to CMR. However, LSMO was completely ferromagnetic metal in this temperature region in case of the LSMO single-layer. Therefore, this magnetoresistance in low temperature should be observed in the junction system rather than the LSMO single-layer. The interaction between BFO and LSMO might exist in the junction. MR ratio of $\sim 50\%$ was obtained under ± 90 kOe at 50 K.

Reference [1] P. Yu *et al.*, Phys. Rev. Lett. **105**, 027201 (2010).

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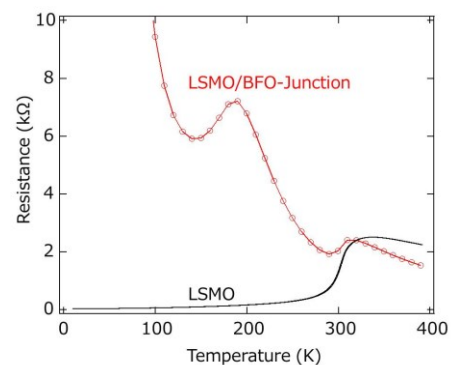


Fig. 1 R - T curves for the LSMO/BFO-junction and LSMO

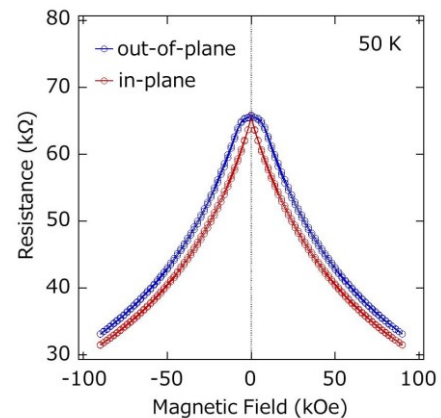


Fig. 2 R - H curves at 50 K for the LSMO/BFO-junction.